

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
17 February 2005 (17.02.2005)

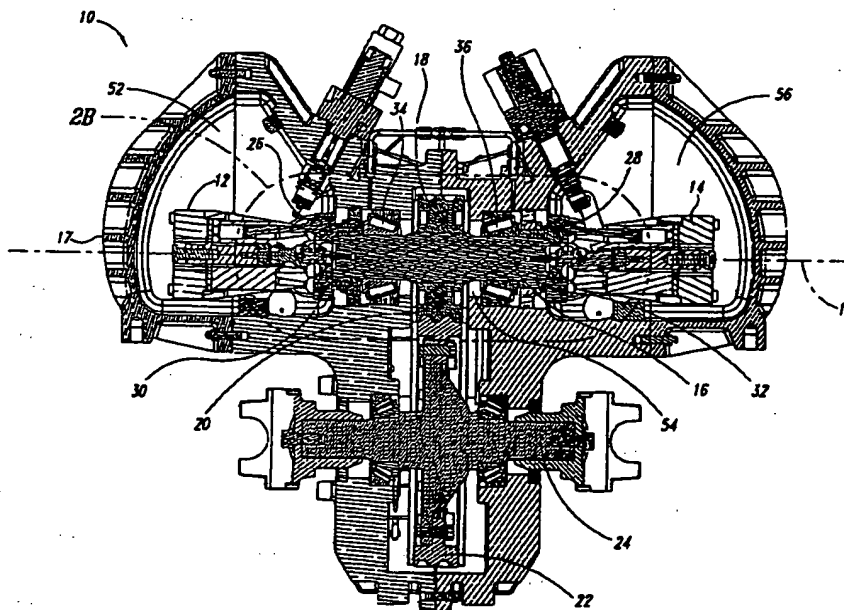
PCT

(10) International Publication Number
WO 2005/014324 A3

- (51) International Patent Classification⁷: B60K 6/00, F01B 3/00, F04B 1/12, F01B 3/10, F04B 1/32
- (21) International Application Number:
PCT/US2004/019274
- (22) International Filing Date: 16 June 2004 (16.06.2004)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
10/620,726 15 July 2003 (15.07.2003) US
- (71) Applicant (for all designated States except US): GOVERNMENT OF THE UNITED STATES OF AMERICA, as represented by THE ADMINISTRATOR OF THE U.S. ENVIRONMENTAL PROTECTION AGENCY [US/US]; 1200 Pennsylvania Avenue N.W., Washington, DC 20460 (US).
- (72) Inventor; and
- (75) Inventor/Applicant (for US only): GRAY, Charles, L., Jr. [US/US]; 4323 Cordley Lake Road, Pinckney, MI 48169 (US).
- (74) Agents: LINFORD, Lorraine et al.; Seed Intellectual Property Law Group PLLC, Suite 6300, 701 - 5th Avenue, Seattle, WA 98104-7092 (US).
- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SI, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: OPPOSING PUMP/MOTORS



(57) Abstract: Two motors (12, 14) are arranged on opposing sides of a common shaft (16), drive plates (30, 32) of the pump/motors (12, 14) being rigidly coupled to each other, for example by being in hard contact with opposing sides of the shaft (16). Control means are provided for selectively moving the two pump/motors substantially simultaneously to a selected displacement angle, using mechanical systems alone and in combination with hydraulic systems.

WO 2005/014324 A3



Published:

— with international search report

(88) Date of publication of the international search report:

19 May 2005

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US2004/019274

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60K6/00 F01B3/00 F04B1/12 F01B3/10 F04B1/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60K F01B F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 01/51870 A (US ENVIRONMENT) 19 July 2001 (2001-07-19) the whole document	1-27
X	CH 325 587 A (THOMA HANS PROF DR ING) 15 November 1957 (1957-11-15) figures 1,3,4,8	1-27
A	US 3 442 181 A (OLDERAAN WILHELMUS FRANCISCUS) 6 May 1969 (1969-05-06) column 5, line 17 - column 6, line 22; claim 1; figures 1,6	1-27
A	US 2 875 701 A (HEINRICH EBERT) 3 March 1959 (1959-03-03) column 2, line 28 - column 3, line 17; figure 1	1-27
	-/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

G document member of the same patent family

Date of the actual completion of the international search

26 January 2005

Date of mailing of the international search report

17. 2. 05

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax (+31-70) 340-3016

Authorized officer

Matos Gonçalves, M

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US2004/019274

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2 956 407 A (GRABOW FRITZ G) 18 October 1960 (1960-10-18) column 4, lines 17-34; figures 1,5	30-40
X	GB 992 334 A (DOWTY HYDRAULIC UNITS LTD) 19 May 1965 (1965-05-19) page 3, lines 10-36; claims 1,3,4; figure 1	30-40
X	DE 15 28 469 A (LINDE AG) 29 April 1971 (1971-04-29) claim 1; figures 1,2	30-40
X	DE 26 49 127 A (LINDE AG) 3 May 1978 (1978-05-03) figure 1	36-40
A	DE 21 01 963 A (MOLLY) 20 July 1972 (1972-07-20) the whole document	28-40
A	US 3 081 647 A (BLENKLE HERBERT A) 19 March 1963 (1963-03-19) figures 1,4-7	28-40
A	EP 1 092 870 A (AIDA ENG LTD) 18 April 2001 (2001-04-18) paragraphs '0030! - '0034!; claims 1,4; figures 3-6	28-40

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2004/019274

Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-27

Hydraulic transmission using opposing pump/motors

2. claims: 28-40

Changing the displacement of a plurality of bent-axis piston machines

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US2004/019274

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 0151870	A	19-07-2001	US 6719080 B1	13-04-2004
			AU 776856 B2	23-09-2004
			AU 2767101 A	24-07-2001
			CA 2394331 A1	19-07-2001
			CN 1394273 T	29-01-2003
			EP 1247055 A1	09-10-2002
			JP 2003519595 T	24-06-2003
			WO 0151870 A1	19-07-2001
			US 2004011031 A1	22-01-2004
			US 2004251067 A1	16-12-2004
CH 325587	A	15-11-1957	NONE	
US 3442181	A	06-05-1969	DE 1254926 B	23-11-1967
			BE 674110 A	15-04-1966
			CH 437956 A	15-06-1967
			GB 1131068 A	23-10-1968
			LU 50078 A	15-02-1966
			NL 6516636 A	23-06-1966
			SE 322666 B	13-04-1970
US 2875701	A	03-03-1959	DE 1030683 B	22-05-1958
			CH 322757 A	30-06-1957
			FR 1106980 A	27-12-1955
US 2956407	A	18-10-1960	NONE	
GB 992334	A	19-05-1965	DE 1453476 A1	08-01-1970
DE 1528469	A	29-04-1971	DE 1528469 A1	29-04-1971
DE 2649127	A	03-05-1978	DE 2649127 A1	03-05-1978
			JP 53055502 A	20-05-1978
DE 2101963	A	20-07-1972	DE 2101963 A1	20-07-1972
			GB 1330430 A	19-09-1973
			US 3760692 A	25-09-1973
US 3081647	A	19-03-1963	NONE	
EP 1092870	A	18-04-2001	JP 2001107843 A	17-04-2001
			CA 2321339 A1	12-04-2001
			EP 1092870 A2	18-04-2001
			US 6422831 B1	23-07-2002